

Pelagia Research Library

European Journal of Experimental Biology, 2013, 3(2):367-370



Influence of a single bout of circuit weight training on cortisol in the morning and evening

¹Majid Mousavizadeh, ²Naser Behpour, ¹Mehdi Roozbahani and ³Seyedhadi Naghibi*

¹Department of Physical Education, Borujerd Branch, Islamic Azad University, Borujerd, Iran ²Department of Physical Education and Sport Sciences, Razi University, Kermanshah, Iran ³Department of Physical Education, Shahrood Branch, Islamic Azad University, Shahrood, Iran

ABSTRACT

The purpose of this study was to examine the Influence of a single bout of circuit weight training on cortisol in the morning and evening. 10 male bodybuilding athletes from Tehran were voluntary selected and all subjects performed a single bout of circuit weight training programming in the morning and evening. (N=10, weight = 85.7 kg, age = 30.80 years, length =178 cm, training time = 8 am. & 16 pm.). Data was classified and described using standard deviation and mean. Data analyzed using Kolmlgroph Smirnof test, independent t-tests and dependent t-test. The results showed there were significant differences between the amount of cortisol hormones secreted of morning and evening in pre-test and post-test, But there were higher cortislo levels in the before and after of morning exercise into the before and after of evening exercise. The findings of this research indicate that cortisol hormones are influenced by the time of training which is due to circadian rhythm and training program in the morning and evening.

Keywords: cortisol, bodybuilding athletes, circuit weight training

INTRODUCTION

It is important, therefore, for coaches and athletes to be aware of how the time of day will affect various components of physical performance (1). Biological rhythms represent ubiquitous regulating mechanisms found in most organisms, including plants, animals, fungi and cyanobacteria. As defined by Haus and Touitou (1994), a biological hythm is a regularly recurring component in a series of measurements of a biologic variable obtained as a function of time. Apart from the rhythms in physics, biological rhythm does not recur exactly to the same initial level (2). Daily levels of cortisol (typically assessed in the morning) can be further affected by infradian variation of e.g., a circaseptan period - highest values on Mondays, the lowest on Thursdays (3), or a circannual period - elevated concentrations during winter (4). Diurnal variation of sports performance usually peaks in the late afternoon, coinciding with increased body temperature. This circadian pattern of performance may be explained by the effect of increased core temperature on peripheral mechanisms, as neural drive does not appear to exhibit nycthemeral variation. This typical diurnal regularity has been reported in a variety of physical activities spanning the energy systems, from Adenosine triphosphate-phosphocreatine (ATP-PC) to anaerobic and aerobic metabolism, and is evident across all muscle contractions (eccentric, isometric, concentric) in a large number of muscle groups. Increased nerve conduction velocity, joint suppleness, increased muscular blood flow, improvements of glycogenolysis and glycolysis, increased environmental temperature, and preferential meteorological conditions may all contribute to diurnal variation in physical performance. However, the diurnal variation in strength performance can be blunted by a repeated-morning resistance training protocol. Optimal adaptations to resistance training (muscle hypertrophy and strength increases) also seem to occur in the late afternoon, which is interesting, since

cortisol and, particularly, testosterone (T) concentrations are higher in the morning. T has repeatedly been linked with resistance training adaptation, and higher concentrations appear preferential. This has been determined by suppression of endogenous production and exogenous supplementation. However, the cortisol (C)/T ratio may indicate the catabolic/anabolic environment of an organism due to their roles in protein degradation and protein synthesis, respectively. The morning elevated T level (seen as beneficial to achieve muscle hypertrophy) may be counteracted by the morning elevated C level and, therefore, protein degradation. Although T levels are higher in the morning, an increased resistance exercise-induced T response has been found in the late afternoon, suggesting greater responsiveness of the hypothalamo-pituitary-testicular axis then. Individual responsiveness has also been observed, with some participants experiencing greater hypertrophy and strength increases in response to strength protocols, whereas others respond preferentially to power, hypertrophy, or strength endurance protocols dependent on which protocol elicited the greatest T response. It appears that physical performance is dependent on a number of endogenous time-dependent factors, which may be masked or confounded by exogenous circadian factors. Strength performance without time-of-day-specific training seems to elicit the typical diurnal pattern, as does resistance training adaptations. The implications for this are (a) athletes are advised to coincide training times with performance times, and (b) individuals may experience greater hypertrophy and strength gains when resistance training protocols are designed dependent on individual T response (5). In human, a vast majority of physiological, biochemical and behavioural processes exhibit daily fluctuations. The simplest explanation of this phenomenon would be that these daily fluctuations may merely reflect different patterns of behavior imposed by the cyclical environment, e.g. sunlight-related night sleep versus diurnal (daylight-related) activity patterns resuling in differential metabolic demands. However, it has been repeatedly shown that when humans or experimentral animals are held in isolation without processes do not become disorganized. Actually, they continue oscillating, with a period of slightly different from that of 24 hours. For instance, periods for body temperature, plasma melatonin and cortisol have been reported to be very similar in duration of 24 hours and 11 minutes on average when measured under an artificial 28-hour day [6]. A single bout of resistance exercise can act as a stressor. At an appropriate level, this can induce a sequential cascade starting with muscle activation, subsequent acute signalling events due to deformation of muscle fibres, followed by acute hormonal and inflammatory responses. With a lag of several hours, protein synthesis peaks, resulting (if higher than protein degradation) in subsequent muscle fibre hypertrophy (7). The magnitude of these processes can be somewhat modulated by manipulation of resistance exercise variables: type of exercise, load, volume, rest period, exercise order (8 & 9). For instance, myofibrillar protein synthesis (10) and acute hormonal response (e.g., increases in serum total and free cortisol, testosteroneand growth hormone, (11) seem to be larger following a hypertrophic type of loading [60-80% of one repetition maximum (1 RM), 6-12 repetitions per set, 3-5 seconds repetition duration, 2-4 sets] as compared to high-load (80-100% of 1 RM, 1-8 repetitions per set, 2-4 sets) and high-speed protocols (40-60% of 1 RM, 5-8 repetitions per set, 2-3 sets) according Kraemer and Häkkinen (12). Addition, biological factors such as muscle fibre type distribution, endocrinological profile, macronutrient intake, age and sex have been recognized for their importance in adaption to strength training (13, 11, 14, 15). Cortisol is a multi-functional hormone typically considered to have catabolic properties counteracting the effects of testosterone. In skeletal muscle, cortisol is involved in protein degradation and it decreases protein synthesis. It may also suppress the HPG axis by inhibiting GnRH (16, 17), stimulate lipolysis in adipose cells and increase gluconeogenesis. Therefore, the role of cortisol in the process of adaptation to strength training may be more complex than purely catabolic, e.g., increasing free amino acid and lipid pool post exercise available for subsequent adaptive protein synthesis (18). A high-volume bout of resistance exercise (moderate-to-high resistance with short rest intervals between sets) induces significant acute elevations in serum cortisol (19, 14). This acute response is typically attenuated with long-term resistance training (20, 21), perhaps partly due to down-regulation of glucocorticoid receptors (22). Differences in the timing of the test and training sessions across the years and/or day may partially contribute to the inconsistency in findings between different studies due to the normal seasonal and circadian fluctuations in testosterone and cortisol. However, it seems that when the overall volume/loading of the strength training (such as 2 or 3 sessions a week) remains within normal physiological range, no systematic changes will occur in the serum concentrations of anabolic and catabolic hormones (23, 13). Indirect evidence also suggests that such training loading would not alter circadian patterns of testosterone and cortisol (24). The purpose of this study was to examine the Influence of a single bout of circuit weight training on cortisol in the morning and evening.

MATERIALS AND METHODS

10 male athletes from Tehran were voluntary selected and all subjects performed a single bout of circuit weight training programming in the morning and evening. (N=10, weight = 85.7 kg, age = 30.80 years, length =178 training time = 8 am. & 16 pm.). Data was classified and described using standard deviation and mean were. For normal distribution of bodybuilding athletes' cortisol levels was used from Kolmlgrof Smirnof test. To examine cortisol levels mean different comparing of bodybuilding athletes between the morning and evening was used the independent t-tests and to examine cortisol levels mean different comparing of bodybuilding athletes between before

and after exercise in the morning and evening was used the dependent t-test. Data based on the standard deviation of the mean were classified and described. All operations were performed using SPSS software version 16.

RESULTS AND DISCUSSION

Table 1 shows the normal distribution of cortisol level bodybuilding athletes using Kolmogorov Smirnov. As Table 1 shows the significant levels of cortisol in the morning (0.935) and afternoon (0.260) data were normally distributed, therefore, was used independent t-test to compare pre-exercise cortisol levels in the morning and pre-exercise cortisol levels in the afternoon practice (Table 2). Also, was used independent t-test for data analyzing between for after practice in the morning and after practice in the afternoon (P value = 0.000). Table 3 Table 4 shows the paired t test to compare cortisol levels before and after exercise in the morning (P value = 0.012) as well as before and after exercise in the evening (P value = 0.422) used

Table1. The results of Kolmogorov Smirnov test in normal distribution of cortisol level

variable	phase	Statistic	P value
Cortisl levels	morning	0.975	0.935
	evening	0.907	0.260

Table2. The results of independent t-test to compare pre-exercise cortisol levels in the morning and pre-exercise cortisol levels in the afternoon practice

	phase	(Std.Error) Mean	t	Free degree	P value
Continel Levels	Before of morning exercise	(11.21) 26.8	5 150	18	**0/000
Corrisol Levels	Before of evening exercise	(4.35) 8	5.139		

Table3. The results of Paired t test to compare cortisol levels before and after evening exercise

	Mean	Std.Deviation	Std.Error Mean	t	Free degree	P value
Cortisol levels (before and after of morning exercise)	-11.22000	-11.29019	3.57027	-3.143	9	0.012*

Table4. The results of Paired t test to compare cortisol levels before and after evening exercise

	Mean	Std.Deviation	Std.Error Mean	t	Free degree	P value
Cortisol levels (before and after of evening exercise)	-1.26000	4.73643	1.49779	841	9	0.422

CONCLUSION

The purpose of this study was to examine the Influence of a single bout of circuit weight training on cortisol in the morning and evening. Lawrence (2010) represented that Optimal adaptations to resistance training (muscle hypertrophy and strength increases) also seem to occur in the late afternoon, which is interesting, since cortisol and, particularly, testosterone (T) concentrations are higher in the morning [5]. Veldhuis (1987) and Van (1996) were shown that Both Serum cortisol and testosterone display a circadian pattern with early morning peaks and evening nadirs [7, 8]. Bird (2004) reported that both testosterone (T) and cortisol (C) exhibit circadian rhythmical being highest in the morning and lowest in the evening. T is a potent stimulator of protein synthesis and may possess anticatabolic properties within skeletal muscle, and C affects protein turnover, thereby altering the balance between hormone-mediated anabolic and catabolic activity. Physiological reactions of these hormones and training adaptations may influence the post-exercise recovery phase by modulating anabolic and catabolic processes, therefore affecting metabolic equilibrium, and may lead to intensification of catabolic processes. [25]. Researcher investigated time of day effects on the testosterone and cortisol of weight-trained men to exercise. Results of this study supports by many studies and researchers [1, 7, 8 and 25]. Tayebisani and et al (2012) were shown that there were significant differences between the amounts of testosterone (0.04) and cortisol (0.01)hormones secreted of both groups in pre-test and post-test. The findings of this research indicate that testosterone and cortisol hormones are influenced by the time of training which is due to circadian rhythm [26].

REFERENCES

[1] Thomas A. Ccappaert. (1999). Journal of Strength and Conditioning Research, 13(4), 412–421.

[2] Milan Sedlik. (**2009**). Neuromuscular and hormonal adaptations to resistance training: special effects of time of day of training Jyväskylä: University of Jyväskylä, 84p.

[3]. Haus E, Touitou S (1994) Biologic Rhythms in Clinical and Laboratory Medicine. Springer Verlag, Berlin:730

[4] Walton JM, Roberts N, Whitehouse GH (1997). Br J Sports Med 31:59-64

[5] Lawrence D. Hayes, Gordon F. Bickerstaff, and Julien S. Baker, *Chronobiology journal*, Jun., **2010**, Vol. 27, No. 4, Pages 675-705

[6] Czeisler CA, Duffy JF, Shanahan TL, Brown EN, Mitchell JF, Rimmer DW, Ronda JM, Silva EJ, Allan JS, Emens JS, Dijk DJ, Kronauer RE, **1999**, *Science* 284: 2177-2188.

[7] Spiering BA, Kraemer WJ, Anderson JM, Armstrong LE, Nindl BC, Volek JS, Maresh CM (**2008**). *Sports Med* 38:527-540

- [8] Kraemer WJ, Fleck SJ, Evans WJ (1996) Exerc Sport Sci Rev 24:363-397.
- [9] Fry AC (**2004**). Sports Med 34:663-679

[10] Kumar V, Selby A, Rankin D, Patel R, Atherton P, Hildebrandt W, Williams J, Smith K, Seynnes O, Hiscock N, Rennie MJ (**2008**). *J Physiol* 15:211-217.

[11] Crewther B, Keogh J, Cronin J, Cook C (2006).. Sports Med 36:215-238

[12] Kraemer WJ, Häkkinen K, Newton RU, McCormick M, Nindl BC, Volek JS, Gotshalk LA, Fleck SJ, Campbell

WW, Gordon SE, Farrell PA, Evans WJ (1998a). Eur J Appl Physiol Occup Physiol 77:206-211

- [13] Kraemer WJ, Ratamess NA (2005) Sports Med 35:339-361
- [14] Folland JP, Williams AG (2007). Sports Med 37:145-168

[15] Hulmi JJ, Kovanen V, Selanne H, Kraemer WJ, Häkkinen K, Mero AA (**2008**) Acute and long-term effects of resistance exercise with or without protein ingestion on muscle hypertrophy and gene expression. Amino Acids.

[16] MacAdams MR, White RH, Chipps BE (1986). Ann Intern Med 104:648-651

[17] Breen KM, Stackpole CA, Clarke IJ, Pytiak AV, Tilbrook AJ, Wagenmaker ER, Young EA, Karsch FJ (2004). *Endocrinology* 145:2739-2746

- [18] Viru AA, Viru M (2001). Human Kinetics, Champaign, IL:296
- [19] Häkkinen K, Pakarinen A (1993). J Appl Physiol 74:882-887

[20] Staron RS, Karapondo DL, Kraemer WJ, Fry AC, Gordon SE, Falkel JE, Hagerman FC, Hikida RS (**1994**). *J Appl Physiol* 76:1247-1255

[21] Kraemer WJ, Häkkinen K, Newton RU, Nindl BC, Volek JS, McCormick M, Gotshalk LA, Gordon SE, Fleck SJ, Campbell WW, Putukian M, Evans WJ (**1999**). *J Appl Physiol* 87:982-992

[22] Willoughby DS, Taylor M, Taylor L (2003). Med Sci Sports Exerc 35:2023-2031

[23] Häkkinen K, Pakarinen A, Kraemer WJ, Newton RU, Alen M (2000). J Gerontol A Biol Sci Med Sci 55:B95-105

[24] Cain SW, Rimmer DW, Duffy JF, Czeisler CA (2007). J Biol Rhythms 22:534-541

- [25] Bird SP, Tarpenning KM. Chronobiol Int. 2004 Jan; 21(1):131-46.
- [26] Seyedmostafa Tayebisani, Pejhman Fooladi, farnaz alikhani, Sedigheh Aghayan, Hassan Gharayagh Zandi (**2012**). *European Journal of Experimental Biology*, 2 (4):1109-1112